> be that which leaves the specimen with a maximum of organization. Sjöstrand's view undoubtedly applies in numerous cases, but it supposes that there is always more order in a living than in a fixed specimen, which may not necessarily be true. (1956c, p. 133)

This controversy further illustrates how investigators evaluate techniques by their results and, in particular, by whether those results conform to expectations generated by theories of the phenomenon. For Palade, buffered osmium was the preferred fixative because it produced results that fit well with biochemistry and his own use of cell fractionation. As we will see in Chapter 6, this is particularly true of two new structures that appeared in the micrographs made with the new fixative – the cristae of the mitochondria and the ribosomes on the endoplasmic reticulum. For Sjöstrand what was critical was generating micrographs that seemed to support very precise measurements of the observed structures.

It is worth noting that even as most researchers had come to accept the reliability of micrographs produced with osmium fixation, there were still doubters. No less an investigator than Jean Brachet expressed his worries about relying on micrographs produced with osmium for definitive accounts of such cell structures as the endoplasmic reticulum:

> One cannot help but admire the very beautiful photographs which have been published, during the past few years, in order to establish and demonstrate the fine structure of the ground cytoplasm; however, the interpretation of the findings is still open to question and the unpleasant problem of the possible artifacts must be raised. It is a matter of some concern that almost all of the work we have just described has been performed on buffered osmium tetroxide fixed tissue; it is hard to believe, from the daily experience of ordinary cytology, that one single fixative can give a trustworthy image of the cell. Careful studies by Frederic (1956), with the so-called 'anoptral' microscope, failed to show the existence of a reticulum in living cells; such a reticulum became conspicuous after osmium fixation only. . . . It is not impossible that the nice double membrane structure, which is so conspicuous in the ergastoplasm and which will be found again in other cell constituents, is nothing but a fixation artifact. Nor can we exclude the possibility that many structures, which do not fix osmium to any large extent, are invisible in present day electron microscopy. (1957, pp. 40–1)

4. A CASE STUDY OF AN ARTIFACT CHARGE

To conclude this chapter, it will be useful to look in some detail at a specific case in which investigators raised the charge of artifact. The case involves the Golgi apparatus, which, as discussed in the previous chapter, had long